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NASA
National Aeronautics and Space Administration

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AO No. OSSA-1-86

MARCH 5, 1986

Announcement of Opportunity

ORIGINAL

UNITED STATES (U.S.) PARTICIPATION IN THE
JAPANESE HIGH ENERGY SOLAR PHYSICS
(HESP) MISSION

NOTICE OF INTENT DUE.....APRIL 18, 1986

PROPOSAL DEADLINE.....JUNE 4, 1986

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ANNOUNCEMENT OF OPPORTUNITY
FOR
UNITED STATES (U.S.) PARTICIPATION IN THE JAPANESE
HIGH ENERGY SOLAR PHYSICS (HESP) MISSION

AO NO. OSSA-1-86 March 5, 1986

1.0 DESCRIPTION OF THE OPPORTUNITY

The Institute of Space and Astronautical Science (ISAS) of Japan is proposing a new space program called the High Energy Solar Physics (HESP) mission, planned for launch into low Earth orbit in the early 1990's. ISAS has invited participation of United States (U.S.) scientists in this HESP mission through the National Aeronautics and Space Administration (NASA). This Announcement of Opportunity (AO) from NASA is in direct response to that invitation by ISAS. This opportunity for participation by U.S. scientists in a Japanese space program will be conducted under the aegis of the U.S.-Japan Agreement on Cooperation in Research and Development in Science and Technology between the two governments. Due to the nature of NASA's agreement with ISAS for this opportunity, only scientists (both Principal Investigators and Co-Investigators) from U.S. institutions will be selected in response to this AO.

The primary goal of the HESP mission is to advance our understanding of high energy phenomena on the Sun through x-ray and gamma-ray observations taken by a carefully coordinated set of instruments carried on a spacecraft intended to be built and launched by ISAS. HESP will, therefore, continue the systematic study of high energy solar processes begun by the NASA Solar Maximum Mission (SMM) and the ISAS HINOTORI mission, both orbited in the early 1980's during the last epoch of maximum solar activity. It is the intent of ISAS to launch HESP in time to observe the next epoch of maximum activity expected in the early 1990's.

This solicitation by NASA for participation in the ISAS HESP mission is for a single scientific investigation from a small team of U.S. scientists who will analyze data derived from the HESP payload for the study and understanding of both energetic and quiet solar phenomena, with particular emphasis on acquisition and use of data from the soft x-ray region of the spectrum (nominally 10-100 Angstroms [A]). It should be noted that the successful U.S. Investigation Team, in order to help meet total mission scientific objectives, will be expected to help design and construct a soft x-ray telescope for the HESP

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payload in conjunction with Japanese HESP scientists. However, since the HESP mission is intended to carry out an integrated study of energetic solar phenomena across the entire high energy part of the spectrum (nominally all wavelengths from soft x-rays to gamma-rays), U.S. proposals should present a broad scientific investigation which will contribute to the total mission and not just to the interpretation of the soft x-ray data.

Two important elements of this intended U.S.-Japan cooperative program are, first, that all U.S. scientists selected through this AO will be designated as Co-Investigators (Co-I's) on HESP by ISAS and will join the overall HESP mission science team headed by a Japanese Project Manager and Project Scientist; and, second, some of the U.S. scientists selected through this AO will be expected to spend substantial time in Japan in order to participate in the HESP mission development, flight operations, and data analysis activities. Further important information on the functions of the U.S. HESP Investigation Team is presented in Section 5.2.

Finally, two additional important programmatic considerations should be noted. First, although ISAS has indicated that final approval and funding for the HESP mission within Japan is anticipated, it is not final as of the date of this AO. Therefore, in the event that HESP is not formally approved, this Announcement of Opportunity does not constitute an obligation on the part of the U.S. Government to carry any selected U.S. investigation through to completion. Second, in the event that HESP is formally approved in Japan for implementation, confirmation of any selections made from the responses to this AO for final development for flight shall be contingent upon the conclusion of an appropriate agreement between NASA and ISAS, which is to be negotiated during the coming year.

The schedule of events associated with this opportunity is as follows:

- Release of the AO	March 5, 1986
- Preproposal Briefing (see Section 6.1)	March 24, 1986
- Notice of Intent due (see Section 6.1)	April 18, 1986
- Proposal Deadline	4:30 EDT, June 4, 1986
- Selection of Investigation	Late August 1986
- Initiation of Investigation Accommodation Study (see Section 7.4)	September 1986.

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2.0 ANNOUNCEMENT OBJECTIVES

The primary objective for U.S. participation in the HESP mission, as solicited by NASA in this Announcement, is to observe and then understand the basic physical processes involved in solar energetic phenomena as revealed in both spectral and imaging data from x-rays through to gamma-rays, with special emphasis on those phenomena observable in the soft x-ray portion of the spectrum.

- By "observe" is meant acquisition of those data that allow derivation of the physical parameters of solar energetic events, namely, the spatial and temporal variations of electron and ion densities, temperatures, elemental abundances, velocity fields, and, if possible, magnetic fields.

- By "understand" is meant the interpretation of these data using the laws of physics in order to physically model the events with regard to their mode(s) of preevent energy storage, method(s) of energy release, and mode(s) of transfer through and/or interaction with the surrounding solar atmosphere.

A secondary objective is the observation and then interpretation of soft x-ray phenomena of the quiet Sun, for example, the magnetic loop structure of active regions, coronal holes, bright points, and coronal arcades over prominence channels. Therefore, taken together with the first objective above, the objective of this Announcement in the broadest terms, is to seek to understand the Sun and all of its phenomena, as revealed in high energy wavelengths, in the astrophysical context of cool stars in general.

A more general description of the overall HESP mission objectives is given in Section 5.1. However, to be considered responsive to this Announcement, proposed investigations must address the objectives described in this section.

3.0 BACKGROUND

3.1 Previous Solar Missions

Significant progress has been made in the last dozen years toward understanding high energy solar processes, of which solar flares are the best known phenomena. The series of Orbiting Solar Observatories (OSO's) through the 1960's and 1970's conclusively showed that solar flares emitted

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copious amounts of high energy radiation from the ultraviolet through to hard x-rays. However, the OSO's generally had inadequate, or nonexistent, imaging capabilities for these wavelengths. The high resolution x-ray telescope on Skylab in 1973-74 provided breakthrough observations by showing that the high energy cores of solar flares are confined to the small (10,000 km or less) magnetic loops that comprise the structure of solar active regions. Unfortunately, Skylab lacked the sensitivity, and especially the time resolution, to reveal changes in structure during the critically important flash phase of the phenomena.

Immediately following Skylab, the Solar Maximum Mission (SMM) (sponsored by NASA) and HINOTORI (sponsored by ISAS) were independently planned to study the flare problem using new generations of instruments and detectors. Whereas both SMM and HINOTORI had higher time resolutions (by factors of 10 or more) at the critical high energy wavelengths, it soon became apparent that both lacked sufficient spatial resolution. However, both of these missions did succeed in unambigously confirming that flares first emerge at the highest energies and at the tops of the small magnetic arches in active regions. In addition, SMM showed that some flares were capable of initially accelerating ions, as well as electrons, to much higher initial energies than previously thought possible.

Together, SMM and HINOTORI set the stage for the planning of the HESP mission, which seeks for the first time to achieve simultaneously both high time resolution (less than 1 sec) and spatial resolution (5 arc sec or better) in hard x-rays (energies 7-70 KeV). It is planned to augment the spatial information to be obtained in hard x-rays with diagnostic spectral data to be provided by an array of spectrometers covering the energies from soft x-rays (1 KeV) through gamma-rays (50 MeV). In addition, the scientists planning HESP recognize that the information obtained from such hard x-ray images will still be inconclusive without understanding where flares occur in the magnetic loop structure of active regions, which in general, can be seen only in soft x-rays. Therefore, an important part of the model payload specified for the HESP mission is a soft x-ray telescope with time and spatial resolutions equal to or better than those of the hard x-ray instrument.

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3.2 History of Japanese-U.S. Solar Research Leading to HESP

Joint U.S.-Japanese cooperation in solar physics has an extended history. Japanese scientists have been regular visitors to U.S. solar ground-based observatories for two decades and participated in the Skylab Workshop on Solar Flares in the latter 1970's as a part of the NASA/ISAS science cooperation program, which includes collaborative research in solar physics. SMM and HINOTORI were simultaneously and independently planned by NASA and ISAS, respectively, with formal cooperative relationships between the scientists for those missions subsequently being established in the late 1970's prior to the launches of the missions. This collaboration at first took the course of only exchanging observing schedules, but later evolved to include exchanges of data and joint participation in data analysis projects as well.

Discussions for the HESP mission between Japanese and U.S. solar scientists began in 1983, and, by the following year, discussions between ISAS and NASA officials had been initiated. In January 1985, U.S. solar scientists were invited to meet with Japanese scientists to help plan an optimum configuration and payload for HESP. By the spring of 1985, an ad hoc group of U.S. solar scientists had produced an informal mission concept report that discussed possible objectives and a model payload for the HESP mission. This report has been instrumental in helping to guide the degree of possible involvement of NASA in this program and is available upon request (see Section 6.1).

The most recent step in establishing this collaboration has been an exchange of letters between ISAS and NASA during the summer and fall of 1985, in which ISAS offered and NASA accepted the opportunity for direct involvement of U.S. scientists in the HESP mission.

3.3 Programmatic Recommendations to NASA

Although the concept of a specific joint Japanese-U.S. space mission to study high energy solar phenomena is recent, in fact, the general goal of understanding the solar flare process is one of the oldest and most important objectives of the U.S. solar space program. For example, the first of the post-Skylab reports of the Space Science Board (SSB) of the National Academy of Science (NAS), entitled "Report on Space Science 1975" (NAS, 1976), explicitly recommended the Solar Maximum Mission and contained an extensive discussion of the astrophysical

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importance of understanding solar flares. Since that report in 1976, nearly every subsequent report issued from the NAS concerning solar physics has discussed the ongoing importance of research on the solar flare problem (see list in Appendix C).

The reason for this emphasis is straightforward. The solar flare represents the only high energy astrophysical phenomenon that can be studied at the very small spatial scales at which the physical processes actually occur. In addition, the study of high energy solar processes allows test of plasma theory and models in domains of temperatures and densities unavailable in the laboratory. Therefore, achieving an understanding of such events will allow extension to apparently similar stellar, and perhaps even cosmic, high energy phenomena now observed with the newest generation of spaceborne, high energy astrophysical instruments. Given this background, the ISAS-NASA HESP opportunity was specifically endorsed by the SSB/Committee on Solar and Space Plasma Physics (see Appendix C) in April 1985.

4.0 PROPOSAL OPPORTUNITY PERIOD

The schedule of events associated with this Announcement of Opportunity is as follows:

- Release AO	March 5, 1986
- Preproposal Briefing (see Section 6.1)	March 24, 1986
- Notice of Intent due (see Section 6.1)	April 18, 1986
- Proposal Deadline	4:30 EDT, June 4, 1986
- Selection of Investigation	Late August 1986
- Initiation of Investigation Accommodation Study (see Section 7.4)	September 1986

5.0 REQUIREMENTS AND CONSTRAINTS

5.1 Description of the HESP Mission

5.1.1 Mission Objectives

The HESP (High Energy Solar Physics) satellite will make high energy observations of solar flares and other forms of solar activity during the solar

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maximum of 1991-1993 with high time, spatial, and spectral resolutions using a wide variety of instruments. Such observations generally aim at understanding the plasma physics of solar flares, including energy storage and release, particle acceleration, and interplanetary (solar-terrestrial) effects.

The Japanese HINOTORI and the U.S. Solar Maximum Mission observations showed that the most important direction for future flare observations lies in high resolution imaging in the higher energy radiations. Therefore, imaging of hard x-rays (above about 30 KeV) is expected to yield important, new information about nonthermal electron acceleration in the flare itself; this electron acceleration almost certainly is one of the most energetically important components of the basic energy-release mechanism.

However, hard x-rays will likely reveal only the hottest (>30 MK) kernal of flares during their flash phases and little about their cooler pre- and post-flash phases. For these latter purposes, observations in soft x-rays are best, since they reveal those magnetic structures which exist prior to the flare and those that fill up with dense, hot plasma (10 - 20 MK) during the later stages of the event. These magnetic structures (which may be one and the same) are observed as expanding, magnetically-confined arches at the start of the flare, the foot points of which are the well-known twin flare filaments observed in visible wavelengths. Therefore, obtaining simultaneous images of flares with comparable high time and spatial resolutions in both the hard and soft x-rays is seen as the primary HESP objective in order that the full morphology of the flare can be observed with sufficient precision to reveal the underlying physical processes.

A second mission observational objective is the imaging of the solar corona in soft x-rays, with both high time and spatial resolutions, to reveal properties of the global coronal magnetic fields as manifested in such features as nonflaring active regions, bright points, coronal holes, and prominences. These HESP X-ray data will, therefore, also provide a major new tool for the study of the global properties of solar magnetism and its evolution during the maximum phase of the solar cycle.

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As a third major mission observational objective, it is expected that HESP will monitor with high precision the Sun's irradiance. The new advance to be carried out by HESP will be to measure variations of photospheric brightness with a modest degree of spatial resolution across the visible disk of the Sun. Such observations represent the next logical step in solar irradiance measurements following the total-Sun irradiance measurements by SMM. It will be possible to study active region evolution and low-order global oscillations with these data, for example.

5.1.2 Candidate Instruments for the Model Payload

In order to give prospective U.S. proposers the fullest possible understanding of the HESP mission, ISAS has provided the following description of the HESP model payload; the first two experiments form the core instrumentation, while the others will be flown as ISAS resources permit.

Hard X-ray Imaging Instrument: This instrument is expected to use Fourier transform optics in the form of a two-grid collimator to achieve an angular resolution of 5 arc sec (FWHM) over a total field of view covering the whole Sun and resolve the hard x-ray range (7 - 70 KeV) into about five energy channels. The time resolution will be limited only by counting statistics and telemetry capacity; some imaging information on time scales shorter than one second should be possible.

Soft X-ray Telescope: If based on standard technology, this instrument would use a grazing incidence mirror with multiple broadband filters in order to image photon energies below a few KeV (nominally 10-100 A). Existing position-sensitive detectors should permit 2-3 arc sec imaging assuming a focal length of about 1.5 m (see Section 5.1.3). However, higher resolution might be achieved with a hybrid design incorporating some type of magnifying optics. The telescope could thus image the whole Sun and transmit several images per orbit for synoptic studies, as well as obtain flare observations with smaller fields of view and time resolution, perhaps as short as one second.

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Bragg Crystal Spectrometer: A scanning flat (or fixed bent) crystal spectrometer would enable the measurement of Doppler shifts and line widths of the x-ray emission lines characteristic of the 1-50 MK plasmas of flares. This spectrometer would respond to radiation from the whole Sun.

Gamma-ray and Neutron Spectrometer: An array of scintillation counters would be capable of observing line and continuum radiation in the range 200 keV - 50 MeV from the whole Sun. These detectors may also directly detect energetic solar neutrons emitted by the most energetic flares.

Hard X-ray Continuum Spectrometer: This scintillation counter spectrometer would cover the energy range 10 keV - 300 keV and be capable of high time resolution and moderate spectral resolution, but with no imaging capability.

Soft X-ray Continuum Spectrometer: This instrument would complement the previous one by using silicon diodes for the energy range 1 - 20 keV, capable of moderate energy resolution better than 10% at 10 keV, but again, with no imaging capability.

Intensity Monitor: Precise measurement of solar irradiance, pioneered by SMM, would be extended by spatially resolving the solar surface using the CCD cameras expected to be used as aspect sensors for the HESP payload.

5.1.3 Description of the Spacecraft

The HESP spacecraft will be one of the series of small ISAS scientific satellites, intended to be launched by the Japanese M-3S-II rocket vehicle from the Kagoshima Space Center during the August-September 1991 launch window. The HESP spacecraft will be the first of the ISAS satellites with three-axis stabilization, oriented toward the center of the Sun.

The HESP spacecraft is expected to have a cylindrical configuration with its long axis pointed in the solar direction and have approximately the following general characteristics:

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Total satellite mass		400 kg
Satellite diameter		1.4 m
Satellite maximum length		2.0 m [a]
Satellite average power		200 w
Payload total mass		120 kg
Payload average power		80 w
Total data recording capacity		80 Mbit
Telemetry rate:	playback	131 kbps
	real time	16 kbps
Command capability		200 command items.

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[a] The maximum satellite length allowable depends upon the mass distribution and its effect on the pointing control system. An individual experiment may not be able to use the full length of the satellite.

Although the spacecraft design is still preliminary, the following total resources are estimated to be available for a Soft X-ray Telescope:

Mass	$\leq$ 30 kg (including electronics)
Length	$\leq$ 2 m (see note [a] above)
Cross section	$\leq$ 30 cm x 30 cm
Total power	$\leq$ 20 watts average (including thermal control of the sensor but not the entire instrument)
Data rate	Approximately half that for HESP (see above).

It should be noted that these values are a guideline only; exact values for the Soft X-ray Telescope will be iterated as part of the final design of the entire satellite, including the payload, by the HESP Project Team once the final payload is selected.

The orbital parameters are expected to be:

Altitude	550 km circular
Period	95 min
Inclination	31 deg.

Three-axis stablilized attitude control, to be achieved by a combination of control moment gyros, a bias momentum wheel and magnetic torquers, should

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provide approximately the following characteristics:

Absolute pointing accuracy	0.1 deg
Drift (long-term)	5 arc sec/min.

It should be noted that although this spacecraft pointing information will be telemetered back, each imaging instrument is expected to provide its own aspect sensor having sufficient accuracy to allow for required data analysis. Also, it should be understood that the HESP attitude control system will have some inherent level of short-term jitter, as do all such systems. However, the exact level of this jitter cannot be specified until further design work is completed.

5.1.4 Project Development and Mission Operations

The principle that governs development of missions at ISAS is similar to that which has been used in some NASA programs to develop total missions within universities or NASA Centers using the in-house scientific staffs for various development tasks, in addition to development of the payload instruments alone. The HESP mission development will, therefore, utilize its entire scientific team, including the selected U.S. Investigation Team to accomplish such tasks as preliminary mission design, operations software development, and actual spacecraft tracking and operations support, in addition to instrument development. All HESP investigators, both Japanese and U.S., will be expected to fully contribute to all the HESP efforts in this "hands-on" mode under the guidance of the HESP Project Manager and Scientist. Selected members of the U.S. HESP Investigation Team should be prepared to spend substantial time in Japan for these purposes.

5.1.5 Project Schedule

U.S. respondents to this AO should assume delivery of any hardware required for implementing their investigation for integration into the HESP spacecraft by April 1990 in order to be ready for launch in August 1991. It is important to note that once the mission-need dates are set by ISAS, they are very firm. For example, ISAS will require the delivery of an engineering model for any U.S. hardware by April 1988, to define the mechanical and

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electrical interfaces. Therefore, U.S. proposal cost estimates must include clearly identified and sufficient reserves (both schedule and financial) to ensure on-time delivery.

5.2 Particular Functions of the U.S. HESP Investigation Team

As a result of extended discussions with ISAS and HESP staff personnel, NASA understands that the U.S. Investigation Team selected through this AO for the HESP program should be prepared to fulfill three particular functions in conjunction with the implementation of their science investigation. Proposers should explicitly address their plans for fulfilling these responsibilities in their proposals.

First, the HESP data base, expected to be provided by the model payload described in Section 5.1.2, will represent an unprecedented resource for solar physics. Its successful acquisition and interpretation will require the talents of scientists who can contribute expertise (both as individuals, as well as part of a team) in: the preparation of space experiment hardware; operation of spacecraft; reduction, archiving, and analysis of data; and finally, modeling and/or development and application of theory in order to understand the observed phenomena. Therefore, in addition to their specifically proposed HESP science investigation, proposing U.S. scientists should demonstrate that they can contribute in a vital and fundamental way to the overall HESP project by virtue of their backgrounds in the preparation of space experiment hardware, the operation of scientific spacecraft, and their scientific expertise as evidenced by publications in the refereed literature. The U.S. HESP Investigation Team will be expected to participate in these activities in close collaboration with the Japanese HESP scientists under the overall guidance of the Japanese HESP Project Scientist and Project Manager. As noted earlier, participation in many of these activites will require that selected members of the U.S. HESP Investigation Team be prepared to spend considerable time in Japan prior to launch and later during the mission operations phases.

Second, consistent with the limited, specific scientific objectives outlined in this Announcement, the U.S. HESP Investigation Team, as part of their investigation, will be expected to aid in the design, fabrication, testing, and operation of the Soft X-ray Telescope for HESP desired by ISAS as part of the model payload (Section 5.1.2). In order to ensure that the interfaces of this instrument

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properly match the spacecraft, NASA has agreed with ISAS that the external housing, including thermal control system and all necessary data handling subsystems of the Soft X-ray Telescope, will be provided by Japanese scientists, one of whom shall be the Principal Investigator of the total Soft X-ray Telescope investigation. With the aid of the combined Japanese and U.S. x-ray investigation team, this Principal Investigator will also be responsible for experiment integration and mission operations. The precise nature of the image forming system, including all optics, the final image detector plus its associated electronics, an optical bench (as required), and any required pointing aspect sensor, is understood to be within the purview of the U.S. science investigation. Proposers must show how any proposed optics system contributes to achieving the specific scientific objectives of this AO (Section 2.0), as well as the overall HESP mission objectives (Section 5.1.1), while not exceeding the expected resources of the HESP spacecraft (Section 5.1.3). Following selection, there will be an Investigation Accommodation Study (see Section 7.4) during which the interface requirements and the relationships between the Japanese and U.S. contributions to the total program will be examined in considerable detail.

The third particular function of the U.S. HESP science investigation team is expected to be in support of the general development and operation of the HESP mission. While it is clear that this responsibility can be met in several possible ways, one particularly direct approach would be for proposing teams to include at least one senior individual with a broad background in high energy solar physics, including experimental techniques, design and operation of spacecraft, and data reduction and analysis, who, in addition to his/her own responsibilities for the proposed U.S. investigation, is committed to working closely with the Japanese HESP staff in the effective role of an Observatory Scientist for the overall planning and execution of the mission. It should be noted that carrying out this function will require frequent and possibly extended trips to Japan. Proposers must clearly indicate in their proposals their plans for providing this general mission support.

5.3 NASA Resources Available for HESP

NASA expects to fund the selected U.S. HESP science investigation through the Explorer Program, consistent with the recent policy statement from the Space Science Board for use of a small fraction of this program for restricted

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efforts of special merit and timeliness which take advantage of unique opportunities. Proposing U.S. scientists should recognize that the resources available for U.S. participation in HESP are limited and propose accordingly.

5.4 Status of U.S. Scientists on the HESP Program

NASA has agreed with ISAS that after selection of the U.S. investigation, all U.S. scientists involved will be designated as Co-Investigators on the HESP mission by ISAS. As such, they will work on the mission as coequals with the Japanese HESP scientists under the guidance of a Japanese HESP Project Manager and Project Scientist. For NASA's contractual purposes, however, the selected U.S. Investigation Team leader will continue to be recognized as a Principal Investigator to NASA.

5.5 U.S./Japan HESP Science Team Interface

NASA feels that a single point of contact should exist between the Japanese HESP staff and the NASA-sponsored U.S. scientific team. Proposals should address how this function will be fulfilled.

5.6 HESP Data Policy

Two outstanding facts dictate the science data policy for HESP. First, the nature of modern research on solar flares requires that the totality of the anticipated HESP data be brought to bear in a coordinated way on the phenomena observed in order that significant progress on the stated mission objectives can be achieved. Second, the limited resources available from ISAS for HESP will limit the rate at which a data bank will be available for scientists outside the official HESP investigation teams and its total extent. Given this background, ISAS and NASA have agreed on the following general data policy:

1. In general, the HESP mission data will be treated as a whole so that scientific topics may be studied to the maximum extent allowed by the totality of the available observations. Therefore, the allocation of scientific topics is expected to be made in a coordinated manner involving the entire HESP science team. In this sense, the HESP data will be treated much as was NASA's Skylab data for the Skylab Solar Workshops carried out during the latter 1970's. It is to be understood that the proposal research plans of the U.S. Investigation Team selected through this AO will be respected in this

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allocation of research topics. However, it is also to be understood that some of the Japanese HESP scientists may be involved in the analysis of the data obtained by a U.S.- supplied instrument and that some of the U.S. scientists may, in a similar fashion, be involved in the analysis of data to be obtained from Japanese-supplied instruments.

2. The scientific groups responsible for the development of specific HESP instruments, including U.S. scientists, will have the lead role for analysis of the initial data before additional Guest Investigators are involved in the program.

3. The participation of U.S. scientists in Japan at the technical level prior to and immediately after launch is expected to continue for some time postlaunch to expedite data analysis in a team effort with the Japanese HESP scientists. The extent and degree to which data from the soft x-ray telescope may be processed in the U.S. will be negotiated during the U.S. Investigation Accommodation Study, planned to follow NASA's selection of the U.S. HESP Investigation Team (see Section 7.4).

4. After some initial period, to be further negotiated between NASA and ISAS, the HESP data base will be made available to the international community through a NASA data center. Once the HESP data are deposited in an accessible data bank, it is the intention of NASA to provide support for extended data analysis, probably through a Guest Investigator Program. Any such program will be announced separately in the future.

6.0 PROPOSAL SUBMISSION AND SELECTION PROCEDURES

6.1 Preproposal Activities

A written Notice of Intent to propose should be submitted by each prospective U.S. Principal Investigator on or before the deadline given in Section 4.0 to:

Dr. J. David Bohlin
NASA HESP Program Scientist
Code EZ
NASA Headquarters
Washington, DC 20546
Telephone Number: 202-453-1466
FTS 453-1466
Telex Number: 089 530.

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This Notice of Intent should briefly describe the objectives of the proposed investigation, including a description of any instrumentation likely to be proposed. Proposers should include the names, addresses, and telephone numbers of all prospective team members and their sponsoring organizations. All material provided to NASA through a Notice of Intent is for information only and is not binding on the signatory. Questions may be directed to the Program Scientist listed above.

A copy of the document entitled "Concept Report: A U.S./Japan Joint Program for High Energy Solar Physics" will be sent to all prospective proposers upon receipt of their Notice of Intent and to any others upon receipt of a written request. This Concept Report was produced by a NASA-sponsored ad hoc group of U.S. scientists who met with ISAS in January 1985, and is intended to provide only background information to prospective proposers. In case of a conflict between concepts outlined in this AO and those in the Concept Report, the provisions of this AO take precedence.

In order to appraise prospective U.S. proposers of the most current plans for HESP, especially concerning the resources likely to be available for the payload, there will be a Preproposal Briefing at NASA Headquarters, starting at 9:00 a.m., eastern standard time (EST), on March 24, 1986. All interested parties may receive further information on this meeting by contacting the HESP Program Scientist.

The following protocol shall apply to the conduct of this Briefing:

a) The HESP Preproposal Briefing will be chaired by the NASA HESP Program Scientist and co-chaired by a Japanese HESP scientist.

b) Japanese HESP Project and scientific personnel will provide a review of the HESP program that is as up-to-date as possible, covering such subjects as science objectives; candidate instruments for the model payload; spacecraft resources for the payload; plans for mission development, operations, and data analysis; and expected project schedule. It shall be understood by prospective U.S. proposers that, while every effort will be made to ensure that such information will be as current as possible, many of the the final HESP specifications will not be determined until the payload instruments are actually chosen and a joint

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Japanese/U.S. HESP mission science team is established and functioning.

c) Following the formal briefing noted in part b) above, the HESP personnel will answer questions submitted by the prospective U.S. proposers. Such questions must be submitted in writing to the U.S. HESP Program Scientist no later than March 20, 1986, and may cover any phase of the HESP program. The author(s) of such questions will not be identified at the briefing. All present at the briefing will be allowed to hear each question and its response. Only questions of clarification will be allowed in real time. The NASA chairman and the Japanese HESP co-chairman will have the right to rule on whether or not a question meets this guideline. The HESP staff will not ask any questions of prospective U.S. proposers. In order to ensure that the information provided at this briefing is available to all prospective proposers, a written record of questions and answers will be kept and made available upon request of the U.S. HESP Program Scientist.

6.2 Format and Content of Proposals

6.2.1 General Proposal Guidelines

A uniform proposal format is required from all proposers in order to facilitate comparative proposal evaluations. General information and general proposal guidelines are additionally provided in Appendices A and B to this AO.

Each proposal should be submitted in two (2) separately bound volumes: Volume 1, Investigation and Technical Plan; and Volume 2, Management and Cost Plan. All documents must be typewritten in English and must be clearly legible. At least one copy of each document should be clear black print on white paper and of a quality suitable for reproduction.

The title pages of both Volumes 1 and 2 must state the titles, names, addresses, affiliations, and telephone numbers of the U.S. Principal Investigator (PI) and all Co-Investigators. Because of the very limited nature of this opportunity, consideration will be restricted to proposals from Principal Investigators and Co-Investigators located at U.S. institutions. The preface to Volume 1 must also include an abstract, one page or less in length,

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describing the proposed investigation. A second page should contain a table listing the major instrument parameters of any hardware proposed. (The title page and these two additional pages are not included in the page limits specified below.)

All proposals must be signed by an official of the U.S. PI's institution who is authorized to certify institutional support and sponsorship, as well as management and financial control, of the proposed investigation.

Thirty (30) copies of Volume 1 (Investigation and Technical Plan) and fifteen (15) copies of Volume 2 (Management Plan and Cost Plan) must be submitted to NASA by all proposers. Proposals must be mailed to the same NASA address as that for the Notice of Intent (see Section 6.1) consistent with the schedule in Section 4.0. NASA will notify the proposers in writing that their proposals have been received. Proposers not receiving this confirmation within 1 week after the deadline should contact the U.S. HESP Program Scientist at the address in Section 6.1.

6.2.2 Investigation and Technical Plan (Volume 1)

Volume 1 should contain the main body of the proposal and any optional appendices. This volume should provide a clear statement of the proposed investigation and how it will address the scientific objectives of the HESP mission (as outlined in Sections 2.0), while maintaining consistency with the expected model payload (Section 5.1.2), spacecraft and NASA resources (Sections 5.1.3 and 5.3, respectively), the missions operations and data analysis plans (Sections 5.1.4 and 5.6, respectively), and the expected project schedule (Section 5.1.5). The proposal should contain enough background information to be meaningful to a reviewer who is generally familiar with the field, although not necessarily a specialist.

The description of any proposed hardware must provide adequate technical information to permit evaluation. In addition, the proposal must specifically address how such hardware can be accommodated within the spacecraft resources and configuration advertised in this AO plus any special requirements necessary for successful

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implementation. This information should be given in sufficient detail to permit an evaluation of both the concept and the practical feasibility of the hardware. The proposal should additionally describe how any data that are to be obtained from proposed hardware are related to that to be obtained from the other instruments of the model payload, and any specific approaches being proposed to maximize the effective use of these data for the study of outstanding problems in solar physics. The proposal should also describe any recognized need for supporting laboratory research or ground-based activities required for development of the instrument and/or its operation during the mission and the proposer's plans for data processing and management.

The main body of Volume 1 is limited to a maximum of forty (40) single-spaced, typewritten pages, without reduction, including illustrations. The roles and responsibilities of the U.S. PI and of each Co-Investigator must be described, along with the time-phasing of their activities. Because the number of scientists on the U.S. HESP Investigation Team will be limited, each participant must have an identified specific function which makes a demonstrable contribution to the development and/or implementation of the investigation. A condensed description of all the relevant backgrounds, experience, and selected publications (related to the objectives of this AO) for each prospective participant should be provided in the body of the proposal.

6.2.3 Management and Cost Plan (Volume 2)

Volume 2 does not have page limitations. It should include a list of the team members who are proposing the investigation with statements of their backgrounds and areas of competence. This Volume should also include a detailed discussion of the specific roles that each of the participants and their institutions intend to play in the investigation. This discussion should include a statement of the portion of time which each participant expects to devote to the investigation and of the institutional resources on which each can draw.

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Volume 2 must also provide a detailed estimate of the total cost to NASA of the investigation, along with sufficient technical information to allow the reliability of the figures to be judged. (Details on Cost Proposal Certifications are provided in the Appendix B to this AO.) The assumptions on which the estimate is based should be stated, particularly with regard to any requested Government-furnished equipment and services. For purposes of this cost proposal, the proposer should assume delivery of any U.S. hardware for integration in April 1990 and launch in August 1991. In particular, it should be carefully noted that once the HESP mission-need dates are established by ISAS, they are very firm. Therefore, proposal cost estimates must include clearly identified and sufficient reserves of both schedule and financial resources to ensure on-time delivery.

7.0 PROPOSAL EVALUATION, SELECTION, AND IMPLEMENTATION

7.1 Evaluation Criteria

The fundamental aim of the investigation acquisition process is to identify scientific ideas and unique instrumental capabilities which best address the overall scientific objectives of the HESP program as described in this AO. Accordingly, the following criteria (in order of decreasing importance) will be used in evaluating all proposals submitted in response to this AO.

1. The scientific and technological merit of the proposed investigation and its relevance to the specific opportunity described in this AO.

2. The adequacy of any hardware proposed for the HESP mission, with particular regard to its ability to supply the data needed for the proposed investigation, within the HESP spacecraft constraints of mass, volume, power, data storage, and transmission rates. Relationships of proposed instrumentation to developed techniques, to previously flown spacecraft instruments, or to existing hardware will be specifically considered.

3. The total cost and management practices. Total cost will be considered to include not only that proposed for any instrument development and for data analysis, but also the projected cost of the investigation during

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mission operations. Management aspects include the capability to deliver any proposed hardware on the schedule required by the HESP project.

4. The competence and relevant experience of the proposing investigation team as an indication of their ability not only to carry the investigation to a successful conclusion, but also to contribute to the end-to-end HESP mission-related activities required by the HESP project.

5. The technical and cost risk (uncertainty) associated with the investigation.

6. The reputation and interest of the proposer's institution, as measured by the willingness of that institution to provide the necessary support (logistics, facilities, etc.) to insure that the investigation can be completed satisfactorily.

7.2 Evaluation Procedures

Proposals received in response to this AO will be evaluated in accordance with the provisions of NASA Handbook NHB 8030.6A (Guidelines for Acquisition of Investigations). All proposals will be subjected to a preliminary technical, management, and cost assessment by NASA to determine their responsiveness to the AO. Proposals not responsive to the intent of the AO will be handled as correspondence and returned to the proposers.

After this preliminary assessment, but before the peer review described below, both sections of each proposal will be scrutinized for technical and fiscal integrity by NASA. The intent of these reviews will be, first, to assess the likelihood that any proposed hardware can be built using state-of-art techniques and be delivered within the mission schedule for HESP; and second, to independently estimate the likely cost-to-NASA for the entire investigation as proposed.

Following these preliminary reviews, the scientific and technical aspects of each proposal will be assessed by a panel of scientific and technical peers of the proposers. A nongovernment organization will be used by NASA to provide assistance in organizing and documenting this panel review process. The purpose of this peer evaluation will be to determine the scientific and technical merit of each proposal expressed in terms of its inherent strengths and weaknesses. Results of the earlier technical and cost

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reviews by NASA will be available to these reviewers. The proposals will not be directly intercompared by this peer review panel.

After these evaluations, a NASA ad hoc Subcommittee of the Space Science and Applications Steering Committee (SSASC) will consider the totality of all proposal evaluations to prepare a ranking of the proposals according to the following categories:

Category I: Well conceived, and scientifically and technically sound investigations pertinent to the goals of the program and the Announcement's objectives and offered by a competent investigator from an institution capable of supplying the necessary support to ensure that any essential flight hardware or other support can be delivered on time and that the data can be properly reduced, analyzed, interpreted, and published in a reasonable time.

Category II: Well conceived, and scientifically and technically sound investigations which are recommended for acceptance, but at a lower priority than Category I.

Category III: Scientifically or technically sound investigations which require further development.

Category IV: Proposed investigations which are recommended for rejection for this particular opportunity, regardless of the reason.

7.3 Selection Procedures

Following the evaluations of the proposals as described above, the NASA HESP Program Directorate (the Astrophysics Division of NASA Headquarters) will develop a recommendation for selection, which will be coordinated with Japan's Institute of Space and Astronomical Science (ISAS). A mutually agreed-upon recommendation and the evaluation information for all of the submitted proposals will then be presented to the SSASC for review. A selection will then be made by the NASA Associate Administrator for Space Science and Applications based on the final recommendation of the SSASC. Results of this selection are anticipated to follow the schedule given in Secton 4.0. Each proposer will be promptly notified in writing of the disposition of his/her proposal.

It should be noted that NASA reserves the right to select only a portion of a proposer's investigation and/or to invite his/her participation with other investigators in a

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joint investigation. In that case, all affected proposers will be given the opportunity to accept or decline such partial acceptance and/or participation with other investigators.

7.4 Implementation Procedures

After selection, it is planned that the selected U.S. science Investigation Team will enter an Investigation Accommodation Study lasting about 12 months. Support provided to the selected U.S. science investigators during this Study will be specifically to develop, in close collaboration with the Japanese HESP science and project staffs, a detailed technical design of any hardware proposed, plus detailed cost-to-NASA and schedule plans for the execution of the entire science investigation for which the U.S. scientists are selected. As noted earlier, it is understood that Japanese scientists may participate in achieving some of the detailed objectives proposed by the U.S. team, and that U.S. scientists may participate in achieving some of the science objectives to be addressed by the Japanese portion of the HESP payload.

At the end of the Investigation Accommodation Study, a Science Confirmation Review will be held by the NASA Astrophysics Division, the purpose of which will be twofold: First, to assess whether the selected U.S. HESP investigatior has achieved a detailed definition of tasks and schedules as determined jointly with the Japanese HESP Project Office, thus reasonably assuring that the objectives of the U.S. investigation may be carried successfully to completion; and, second, to assess whether the selected U.S. HESP investigation can be carried out at a cost acceptable to NASA.

Subject to these two conditions, plus the conclusion of a NASA/ISAS agreement for participation in the HESP program, final confirmation for development for flight of the U.S. HESP investigation will be made by the NASA Associate Administrator for Space Science and Applications. At that time, it is understood that all of the U.S. scientists will be designated as Co-Investigators on the HESP mission by ISAS. NASA will continue to deal with the designated Principal Investigator of the U.S. HESP Investigation Team concerning all contractual matters.

Following selection, direct responsibility for establishing a contract with the institution of the PI of the U.S. HESP Investigation Team will be assigned to a NASA field center. It is expected that funding for the Investigation

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Accommodation Study will begin quickly thereafter. NASA intends to provide the appropriate degree of management oversight needed to ensure that any hardware developed for delivery to ISAS meets reasonably acceptable standards of quality for space flight and that the costs charged to NASA for the overall U.S. investigation remain within established budgets. However, it will be largely left to the U.S. PI for HESP and his/her Japanese counterpart to determine whether any U.S.-developed hardware meets the requirements for successful incorporation into the HESP payload. In order to facilitate export to Japan, NASA expects to take final delivery of any U.S.-provided hardware for HESP in order to serve as the export agent to ISAS.

8.0 SUMMARY

This Announcement of Opportunity (AO) is in direct response to an invitation from the Institute of Space and Astronautical Science (ISAS) of Japan for U.S. scientific participation in their next solar mission, called the High Energy Solar Physics (HESP) mission, intended to be launched in 1991. This mission represents an excellent successor to the successful SMM and HINOTORI programs carried out by NASA and ISAS, respectively, during the last epoch of maximum solar activity in the early 1980's and is responsive to the recommendations NASA continues to receive for the aggressive study of high energy solar phenomena.

In addition, this offer from ISAS to NASA for cooperation on HESP represents a significant step in the growth of cooperation in the sciences between the U.S. and Japan. This cooperative program will be conducted under the U.S.-Japan Agreement on Cooperation in Research and Development in Science and Technology which has been agreed to between the two governments. NASA is pleased to be able to offer its support for this ISAS program and hereby invites the the U.S. science community to propose investigations as outlined in this AO.

B. I. Edelson
Associate Administrator for
Space Science and Applications

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APPENDIX A: GENERAL INSTRUCTIONS AND PROVISIONS

I. PROCUREMENT OF INSTRUMENTATION AND/OR GROUND EQUIPMENT

By submitting a proposal to NASA, the investigator and his/her institution agree that NASA has the option to accept all or part of the proposer's plan to provide the instrumentation or ground support equipment required for the investigation. NASA may furnish or obtain such instrumentation or equipment from any other source as determined by the selecting official. In addition, NASA reserves the right to require use, by the selected investigator, of U.S. Government instrumentation or property that subsequently becomes available, with or without modification, that will meet the investigative objectives.

II. TENTATIVE SELECTIONS, PHASED DEVELOPMENT, PARTIAL SELECTIONS, AND PARTICIPATION WITH OTHERS

By submitting a proposal to NASA, the investigator and his/her institution agree that NASA has the option to make a tentative selection pending a successful feasibility or definition study of the proposed investigation and, in addition, in case of investigations that are not entirely funded by NASA, upon confirmation of the availability of adequate financial support by the proposer's institution. Furthermore, NASA has the option to contract in phases for implementation of a proposed investigation and to discontinue the investigative effort at the completion of any phase.

The investigator should also understand that NASA may desire to select only a portion of the proposed investigation and/or may desire the individual's participation with other investigators in a joint investigation, in which case the investigator will be given the opportunity to accept or decline such partial acceptance or participation with other investigators prior to a NASA selection. Where joint participation with other investigators is agreed to, a single individual will be designated as the leader or contact point for the investigator group.

III. SELECTION WITHOUT DISCUSSION OR AFTER LIMITED DISCUSSION

The U.S. Government reserves the right to reject any or all proposals received in response to this Announcement when such action shall be considered in the best interest of the Government. Notice is also given of the possibility that any selection may be made without discussion or after limited discussion. It is, therefore, emphasized that all proposals should be submitted initially on the most favorable terms that the offeror can submit.

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IV. TREATMENT OF PROPOSAL DATA

The following will apply in the treatment of proposal data received in response to this Announcement.

It is NASA policy to use information contained in proposals and quotations for evaluation purposes only. While this policy does not require that the proposal or quotation bear a restrictive notice, offerors or quoters should, in order to maximize protection of trade secrets or other information that is commercial or financial and confidential or privileged, place the following notice on the title page of the proposal or quotation and specify the information, subject to the notice by inserting appropriate identification, such as page numbers, in the notice. In any event, information (data) contained in proposals and quotations will be protected to the extent permitted by law, but NASA assumes no liability for use and disclosure of information not made subject to the notice.

RESTRICTION ON USE AND
DISCLOSURE OF
PROPOSAL AND QUOTATION INFORMATION (DATA)

The information (data) contained in ..... (insert page numbers or other identification)..... of this proposal or quotation constitutes a trade secret and/or information that is commercial or financial and confidential or priviledged. It is furnished to the Government in confidence with the understanding that it will not, without permission of the offeror, be used or disclosed for other than evaluation purposes; provided, however, that in the event a contract is awarded on the basis of this proposal or quotation, the Government shall have the right to use and disclose this information (data) to the extent provided in the contract. This restriction does not limit the Government's right to use or disclose this information (data) if obtained from another source without restriction.

V. STATUS OF COST PROPOSALS

The investigator's institution agrees that the cost proposal submitted in response to the Announcement is for proposal evaluation and selection purposes and that, following selection and during negotiations leading to a definitive contract, the institution will be required to resubmit or execute final cost as required by law and regulation. U.S. proposers may execute a DD Form 633 (Contract Pricing Proposal) to fulfill this requirement.

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VI. LATE PROPOSALS

NASA reserves the right to consider proposals or proposal modifications received after the submission deadline, but prior to the date of selection, should such action be in the interest of the U.S. Government.

VII. DISCLOSURE OF PROPOSALS OUTSIDE THE U.S. GOVERNMENT FOR THE PURPOSE OF EVALUATION

NASA may find it necessary to obtain proposal evaluation assistance outside the U.S. Government. Where NASA determines it is necessary to disclose a proposal outside the Government for evaluation purposes, arrangements will be made with the evaluator for appropriate handling of the proposal information. Therefore, by submitting a proposal, the investigator and institution agree that NASA may have the proposal evaluated outside the Government. If the investigator or institution desire to preclude NASA from using an outside evaluation, the investigator or institution should so indicate on the cover. However, notice is given that if NASA is precluded from using outside evaluation, it may be unable to consider the proposal.

VIII. EQUAL OPPORTUNITY

By submitting a proposal, the investigator and his/her institution agree to accept the following clause in any resulting contract:

EQUAL OPPORTUNITY (JUNE 1973)

During the performance of this contract, the Contractor agrees as follows:

(1) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoffs or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post inconspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this nondiscrimination clause.

(2) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the

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Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

(3) The Contractor will send to each labor union or representative of workers with which the contractor has a collective bargaining agreement or other contract or understanding a notice to be provided by the Agency Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this nondiscrimination clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(4) The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 or October 13, 1967, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(5) The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and by the rules, regulations, and orders of the Secretary of Labor or pursuant thereto, and will permit access to the Contractor's books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(6) In the event of the Contractor's noncompliance with the Equal Opportunity clause of this contract or with any of the said rules, regulations, or orders, this contract may be cancelled, terminated, or suspended, in whole or in part, and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(7) The Contractor will include the provisions of Paragraph (1) through (7) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246 of September 24, 1965, as amended by Executive Order 11375 of October 13, 1967, so that such provisions will be binding upon each subcontractor or

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vendor. The Contractor will take such action with respect to any subcontract or purchase order as the contracting agency may direct as a means of enforcing such provisions including sanctions for noncompliance: provided, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the contracting agency, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

IX. INVENTION AND DATA RIGHTS

The following will be applicable to any contract resulting from a selection under this Announcement:

(a) If the contract is with a small business firm or a nonprofit organization, the clause at FAR 52.227-11, Patent Rights--Retention by the Contractor (Short Form) with the modification specified at NFS 18-52.227-11, shall be inserted in the contract. If the contract is with an entity other than a small business firm or nonprofit organization, the clause at NSF 18-52.227-70, New Technology, shall be inserted in the contract.

(b) The clause at 18-52.227-74, Rights in Data--General, shall apply to the extent consistent with the agreement between NASA and ISAS.

X. EXPERIMENT EQUIPMENT FLIGHT WORTHINESS

By submitting a proposal, the investigator's institution agrees that if their proposal is selected, all flight hardware proposed will be required to comply with nominally accepted standards for space flight worthiness. This must be accomplished by the organization managing the acquisition of equipment. Flight worthiness requirements will be those necessary to ensure a reasonable probability of satisfactory mission performance of the experiment equipment (reliability and quality assurance). Investigators selected to provide experiment equipment will be advised of the pertinent flight worthiness requirements for the mission and experiment in a timely manner by NASA.

It should be further noted that since the hardware which may be associated with investigations submitted in response to this AO is expressly for part of a scientific payload intended to be carried by a spacecraft and launched by a rocket all provided by ISAS of Japan, the proposing investigators should also be prepared to comply with whatever flight safety and worthiness requirements may be imposed by ISAS. Such requirements will be provided in a timely manner by ISAS during the Investigaton Accommodation Study Phase.

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APPENDIX B: GUIDELINES FOR PROPOSAL PREPARATION

The following guidelines apply to the preparation of proposals by potential investigators in response to an Announcement of Opportunity. The material presented is merely a guide for the prospective proposer, and it is not intended to be all encompassing or directly applicable to the various types of proposals which can be submitted. The proposer should, however, provide information relative to those items applicable or as otherwise required by the Announcement of Opportunity.

A. COVER LETTER

A letter or cover page should be forwarded with the proposal. It should be signed by the investigator and an official by title of the investigator's organization who is authorized to commit the organization that is responsible for the proposal and its contents.

B. TABLE OF CONTENTS

The proposal should contain a table of contents.

C. IDENTIFYING INFORMATION

The proposal should contain a short descriptive title for the investigation, the names of all investigators, and the names of their organizations or institutions. The full name of the Principal Investigator, address with zip code, and telephone number should be included.

I. INVESTIGATION AND TECHNICAL PLAN

A. INVESTIGATION AND TECHNICAL PLAN

The investigation and technical plan generally will contain the following:

1. Summary. A simple, concise statement about the investigation, its conduct, and the anticipated results.

2. Objectives and Significant Aspects. A brief definition of the objectives, their value, and their relationships to past, current, and future efforts. The history and basis for the proposal and a demonstration of the need for such an investigation. A statement of present development in the discipline field.

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3. Investigation Approach.

a. Fully describe the concept of the investigation.

b. Detail the method and procedures for carrying out the investigation.

B. INSTRUMENTATION

This section should describe all information necessary to plan for experiment development, integration, ground operations, and flight operations. This section must be complete in itself without the need to request additional data. Failure to furnish and complete data may preclude evaluation of the proposal.

1. Instrument Description. This section should fully describe the instrumentation and indicate items which are proposed to be developed, as well as any existing instrumentation. Performance characteristics should be related to the experiment objectives as stated in the proposal.

2. Instrument Integration. This section should describe all parameters of the instrument pertinent to the accommodation of the instrument in the spacecraft. These include, but are not limited to: volumetric envelope, weight, power requirements, thermal requirements, telemetry requirements, sensitivity to or generation of contamination (e.g., electromagnetic interference, gaseous effluents), data processing requirements.

3. Ground Operations. This section should identify requirements for prelaunch or postlaunch ground operations support.

4. Flight Operations. This section should identify any requirements for flight operations support including mission planning. Operational constraints, viewing requirements, and pointing requirements should also be identified. Describe any special communications, tracking, or near real-time ground support requirements and indicate any special equipment or skills required of ground personnel.

C. DATA REDUCTION AND ANALYSIS

A discussion of the data reduction and analysis plan including, insofar as possible, the method and format. A section of the plan should include a schedule for the submission of reduced data to the receiving point as specified in this Announcement of Opportunity.

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II. MANAGEMENT PLAN AND COST PLAN

A. MANAGEMENT PLAN

The management plan should summarize the management approach and the facilities and equipment required.

1. Management

a. The management plan sets forth the investigator's approach for managing the work, the recognition of essential management functions, and the overall integration of these functions.

b. The management plan gives insight into the organization proposed for the work, including the internal operations and lines of authority with delegations, together with internal interfaces and relationships with NASA, major subcontractors, and associated investigators. Likewise, the management plan usually reflects various schedules necessary for the logical and timely pursuit of the work, accompanied by a description of the investigator's work plan and the responsibilities of the co-investigators.

c. The plan should describe the proposed method of instrument acquisition. Specifically, it should include the following, as applicable:

(1) Rationale for the investigator to obtain the instrument through or by the investigator's institution.

(2) Method and basis for the selection of the proposed instrument fabricator.

(3) Unique or proprietary capabilities of the instrument fabricator that are not available from any other source.

(4) Contributions or characteristics of the proposed fabricator's instrument that make it an inseparable part of the investigation.

(5) Availability of supporting personnel in the institution to successfully administer the instrument contract and technically monitor the fabrication.

(6) Status of development of the instrument, e.g., what additional development is needed. Areas that need further design or in which unknowns are present.

(7) Method by which the investigator proposes to:

(a) Prepare instrument specifications
(b) Review development progress
(c) Review design and fabrication changes

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(d) Participate in testing program
(e) Participate in final checkout and calibration
(f) Provide for integration of the instrument
(g) Support the flight operations
(h) Coordinate with co-investigators, other related investigations, and the payload integrator
(i) Assure safety, reliability, and quality

(8) Planned participation by small and/or minority business in any subcontracting for instrument fabrication or investigative support functions.

2. Facilities and Equipment

All major facilities, laboratory equipment, and ground-support equipment (GSE) (including those of the investigator's proposed contractors and those of NASA and other U.S. Government agencies) essential to the experiment in terms of its system and subsystems are to be indicated, distinguishing insofar as possible between those already in existence and those that will be developed in order to execute the investigation. The outline of new facilities and equipment should also indicate the lead time involved and the planned schedule for construction, modification, and/or acquisition of the facilities.

B. COST PLAN

The cost plan should summarize the total estimated investigation cost by major categories of cost, as well as by function.

1. The categories of cost should include the following:

a. Director Labor. List by labor category, with labor-hours and rates for each. Provide actual salaries of all personnel and the percentage of time each individual will devote to the effort.

b. Overhead. Include indirect costs which, because of their incurrence for common or joint objectives, are not readily subject to treatment as a direct cost. Usually this is in the form of a percentage of the direct labor costs.

c. Materials. This should give the total cost of the bill of materials, including estimated cost of each major item. Include lead time of critical items.

d. Subcontracts. List those over $25,000, specify the vendor and the basis for estimated costs. Include any baseline or supporting studies.

e. Special Equipment. Include a list of special equipment with lead and/or development time.

f. Travel. List estimated number of trips, destinations, duration, purpose, number of travelers, and anticipated dates.

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g. Other Costs. Cost not covered elsewhere.

h. General and Administrative Expense. This includes the expenses of the institution's general and executive offices and other miscellaneous expenses related to the overall business.

i. Fee. (if applicable).

2. Separate schedules, in the above format, should be attached to show total cost allocable to the following:

a. Principal Investigator and other Investigator's costs

b. Instrument costs

c. Integration costs

d. Data reduction and analysis, including the amount and cost of computer time

3. If the effort is sufficiently known and defined, a funding obligation plan should provide the proposed funding requirements of the investigations by quarter and/or annum keyed to the work schedule.

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APPENDIC C: BIBLIOGRAPHY OF RELEVANT REPORTS AND RECOMMENDATIONS

I. SUMMARY OF FORMAL PUBLISHED REPORTS

All of the following reports have been issued by the National Academy of Sciences since 1976 through the auspices of its Space Science Board (SSB) or the SSB Committee on Solar and Space Physics (CSSP), the Committee on Solar-Terrestrial Research (CSTR) of the Board on Atmospheric Sciences and Climate, or one of several ad hoc panels (in particular, the Astronomy Survey Committee in 1982, and the Panel on the Physics of the Sun in 1985). The page numbers given are those for which recommendations for and/or discussion of the value of the study of high energy solar phenomena are given.

1976: Report on Space Science (pp. 14; 149-150; 185-191; 209-210).

1978: Space Plasma Physics/The Study of Solar-System Plasmas (pp. 90-94).

1979: A Stratedy for Space Astronomy and Astrophysics for the 1980's (pp. 95-97).

1980: Solar-System Space Physics in the 1980's/A Research Strategy (pp. 7-9; 23; 47-48).

1981: Solar-Terrestrial Research for the 1980's (pp. 11-13; 26-27; 43; 47-48; 70-76; 134).

1982: Astronomy and Astrophysics for the 1980's/Volume 1: Report of the Astronomy Survey Committee (pp. 76-80).

1984: National Solar-Terrestrial Research Program (pp. 5-6).

1985: The Physics of the Sun (pp. 14-15; 22; 46-48; 61-62).

1985: An Implementation Plan for Priorities in Solar-System Space Physics/Executive Summary (pp. 17; 23).

II. RECOMMENDATION FOR U.S. PARTICIPATION IN HESP

The following is the complete text of the recommendation by the CSSP, dated April 26, 1985, for NASA support of limited participation by U.S. scientists in the HESP program:

"Based upon a briefing made to the CSSP on March 7, 1985, by NASA, concerning the potential for participation by U.S. scientists in the Japanese High Energy Solar Plasma (HESP)

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Mission under consideration by the Institute for Space and Astronautical Sciences (ISAS), the CSSP addressed the following issues: quality of the proposed science, and compatibility with the overall scientific objectives of solar and space physics. The major proposed U.S. contribution to HESP would be the optics and detector for a state-of-the-art soft x-ray telescope, which U.S. scientists are uniquely qualified to provide. These scientists would serve as Co-Investigators and a Japanese as the Principal Investigator for this experiment. In addition, a few other U.S. scientists may be selected to serve as Co-Investigators for the other HESP experiments, but without hardware responsibility.

"HESP offers a unique opportunity for U.S. solar scientists to actively participate in a space mission during the next solar maximum, 1991-1993, as part of a joint research program with Japan into fundamental questions of the explosive energy release in solar flares and other high energy solar phenomena. To understand solar flares, it is essential to have simultaneous high spatial resolution, hard and soft x-ray images. This information is needed to understand the physical interrelationships between thermal and nonthermal processes in flares. Problems to be addressed include, for example, the role of these electron beams and conduction fronts in producing chromospheric evaporation, the production sites for hard x-ray emission and their relationship to hot, "thermal" flare kernels, and transport processes such as anomalous conductivity.

"Since no other U.S. mission devoted to high energy solar phenomena is planned for the next solar maximum, the HESP data will uniquely provide such observations in that epoch. In addition, HESP data may overlap with the low energy (visible light and UV) observations obtained from the Solar Optical Telescope (SOT) which is also scheduled for flight in 1991. Thus, these measurements are compatible with and complement plans outlined in the recent CSSP report "An Implementation Plan for Solar System Space Physics" (NAS, in press, 1985).

"Thus, the Committee on Solar and Space Physics urges NASA to proceed with this U.S./Japanese collaboration, if further detailed study confirms the cost-effectiveness and feasibility of accomplishing these important scientific objectives."

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